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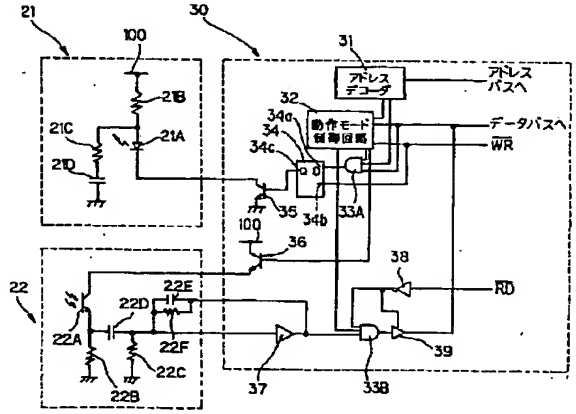
(54)【発明の名称】　光通信装置を備えたゲーム装置

(57)【要約】

【課題】　使用電力に制限がある場合でも負荷を増大させることなく、発光側の作動初期の発光強度を大にして受信側の応答性、正確性を向上させることができる光送受信装置を備えたゲーム装置を提供する。

【解決手段】　発光部２１に設けられるＬＥＤ２１Ａと並列にコンデンサ２１Ｄを設け、ＬＥＤ２１Ａの作動時に電源１００に基づく注入電流とコンデンサ２１Ｄに充電された電荷に基づく注入電流の和の注入電流を供給するようにした。



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【特許請求の範囲】
【請求項１】　プログラムの実行に基づいて外部機器に光信号を出射する発光器と、前記外部機器より出射される光信号を受光する受光器を有する光通信装置を備えたゲーム装置において、
前記発光器の非作動時に電源から供給される電荷を蓄積するコンデンサを有し、前記発光器の作動時に前記電源に基づく第１の注入電流と前記コンデンサの電荷に基づく第２の注入電流の和の注入電流を供給して前記発光器を作動させる発光回路と、
前記外部機器より出射される光信号の受光に基づいて発生する出力信号を読み取り信号に同期してリードする受光回路を備えたことを特徴とする光通信装置を備えたゲーム装置。
【請求項２】　前記発光回路および前記受光回路は、第１の携帯型ゲーム装置に組み込まれており、前記外部機器は、前記発光回路および前記受光回路と同一の発光回路および受光回路を有する第２の携帯型ゲーム装置であり、
前記第１および第２の携帯型ゲーム装置は、一方の携帯型ゲーム装置の前記発光部ともう一方の携帯型ゲーム装置の前記受光部、および一方の携帯型ゲーム装置の前記受光部ともう一方の携帯型ゲーム装置の前記発光部が対向するように構成され、対向する発光部および受光部を近接して配置して光通信を行う構成の請求項第１項記載の光通信装置を備えたゲーム装置。
【請求項３】　前記発光器および前記受光器は、プログラムおよびデータを格納する記憶素子を有する着脱可能なメモリカードに設けられる請求項第１項記載の光通信装置を備えたゲーム装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は光通信装置を備えたゲーム装置に関し、特に、使用電力に制限のある携帯型ゲーム装置間の光通信を可能とし、かつ、受信側の応答性、正確性に優れる光通信装置を備えたゲーム装置に関する。
【０００２】
【従来技術】従来のゲーム装置として、携帯型ゲーム装置間で光信号を送受信することによりプログラムに基づくデータ通信を行うようにした光通信装置を備えたゲーム装置がある。
【０００３】図６は、従来の光通信装置の発光部を示し、電源５５に抵抗５６を介して接続され、スイッチ５７のＯＮ／ＯＦＦに基づいて点灯する発光素子（ＬＥＤ）５８を有し、スイッチ５７をＯＮすることによってＬＥＤ５８が点灯する。ＬＥＤ５８の点灯に基づいて出射される光信号は、他のゲーム装置の受光部（図示せず）に入射して光電変換され、受光信号として出力される。

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【０００４】図７(a),(b)は、発光部および受光部に供給される電流と時間の関係を示し、時刻t_1において発光部をＯＮすると、ＬＥＤ５８には図７(a)に示すように電源から注入電流I_Aが供給される。一方、受光部は、ＬＥＤ５８の発光に基づく光信号を受光することによって光電流を生じる。この光電流は図７(b)に示すように時刻t_1から上昇し、Δt秒後の時刻t_2に電流値I_Bに達する。
【０００５】
【発明が解決しようとする課題】しかし、従来の光通信装置によると、発光部で消費される電力を節約するために発光素子と直列に所定の値を有した抵抗を挿入しているので、発光素子を作動させても、発光素子に注入される電流のレベルは制限され、その結果、受光素子が充分な光量の光を受光するまで時間を要し、受信側の反応が不正確になる恐れがある。従って、本発明の目的は使用電力に制限がある場合でも負荷を増大させることなく、発光側の作動時の注入電流のレベルを大にして受信側の応答性、正確性を向上させることができる光通信装置を備えたゲーム装置を提供することにある。
【０００６】
【課題を解決するための手段】本発明は上記した目的を実現するため、プログラムの実行に基づいて外部機器に光信号を出射する発光器と、前記外部機器より出射される光信号を受光する受光器を有する光通信装置を備えたゲーム装置において、前記発光器の非作動時に電源から供給される電荷を蓄積するコンデンサを有し、前記発光器の作動時に前記電源に基づく第１の注入電流と前記コンデンサの電荷に基づく第２の注入電流の和の注入電流を供給して前記発光器を作動させる発光回路と、前記外部機器より出射される光信号の受光に基づいて発生する出力信号を読み取り信号に同期してリードする受光回路を備えたゲーム装置を提供する。
【０００７】上記した光通信装置を備えたゲーム装置において、発光回路および受光回路は、第１の携帯型ゲーム装置に組み込まれており、外部機器は、発光回路および受光回路と同一の発光回路および受光回路を有する第２の携帯型ゲーム装置であり、第１および第２の携帯型ゲーム装置は、一方の携帯型ゲーム装置の発光部ともう一方の携帯型ゲーム装置の受光部、および一方の携帯型ゲーム装置の受光部ともう一方の携帯型ゲーム装置の発光部が対向するように構成され、対向する発光部および受光部を近接して配置することにより光通信を行う構成とすることが好ましい。また、発光器および受光器は、プログラムおよびデータを格納する記憶素子を有する着脱可能なメモリカードに設けることもできる。
【０００８】
【発明の実施の形態】図１は、本発明の実施の形態における光通信装置を備えた携帯型ゲーム装置を示し、前面に液晶ディスプレイ１１、十字キー１２、操作ボタン１

３および１４が配置された本体１０と、本体１０に着脱自在に装着されるメモリカード２０を有し、メモリカード２０の天面にはデータに基づく光信号の送受信を行う発光部２１および受光部２２が設けられている。

【０００９】図２は、メモリカード２０の制御ブロック図を示す。このメモリカード２０は、各部の動作を制御する制御部３０を有し、制御部３０から出力される制御信号に基づいて光信号を発生するＬＥＤ２１Ａ、受光した光信号を光強度に応じて光電変換するフォトトランジスタ２２Ａ、プログラムを格納したＲＯＭ５０、ゲーム実行中に発生するデータを格納するＲＡＭ５１、本体１０からメモリカード２０を取り外したとき電池４０からＲＡＭ５１に電力を供給して格納されたゲームのデータを保護するリセット回路４１、本体１０に内蔵されてアドレス、データ、書き込み信号ＷＲバー、読み込み信号ＲＤバーを制御部３０に入力するＣＰＵα６０を接続して構成されている。

【００１０】図３は、メモリカード２０の光通信部の回路図を示し、制御部３０に発光部２１と受光部２２を接続して構成されている。

【００１１】発光部２１は、ＬＥＤ２１Ａ、抵抗２１Ｂ，２１Ｃ，およびコンデンサ２１Ｄを有し、電源１００に抵抗２１Ｂを介して接続されるＬＥＤ２１Ａは制御部３０のトランジスタ３５に接続されている。また、ＬＥＤ２１Ａと並列にコンデンサ２１Ｄが抵抗２１Ｃを介して接続されており、電源１００の電力消費を節減するために抵抗２１Ｂの抵抗値は抵抗２１Ｃの抵抗値より大になるように設定されている。電源１００は、制御部３０によって「通信モード」が設定されるとトランジスタ３５がＯＮして通電する。

【００１２】コンデンサ２１Ｄは、ＬＥＤ２１Ａの点灯間の消灯時に電荷を充電し、トランジスタ３５の導通時に電源に基づく注入電流と、コンデンサ２１Ｄに充電された電荷に基づく注入電流の和の注入電流をＬＥＤ２１Ａに供給する。

【００１３】受光部２２は、フォトトランジスタ２２Ａ、抵抗２２Ｂ，２２Ｃ、コンデンサ２２Ｄ，２２Ｅ、および抵抗２２Ｆを有し、フォトトランジスタ２２Ａは制御部３０のトランジスタ３６と接続され、光電流－電圧変換用抵抗２２Ｂを介して接地されている。また、抵抗２２Ｂに並列に抵抗２２Ｃがコンデンサ２２Ｄを介して接続されている。コンデンサ２２Ｄの出力端子は制御部３０のアンプ３７に接続されており、アンプ３７に並列に抵抗２２Ｆおよびコンデンサ２２Ｅが接続されて帰還増幅回路を構成している。

【００１４】制御部３０は、アドレスデコーダ３１、動作モード制御回路３２、アンドゲート３３Ａ，３３Ｂ、Ｄ－フリップフロップ３４、トランジスタ３５，３６、アンプ３７、インバータ３８、バッファ３９より構成されている。

【００１５】アドレスデコーダ３１は、動作モード制御回路３２およびアンドゲート３３Ａと接続されている。動作モード制御回路３２は、アンドゲート３３Ａ，３３Ｂ、およびトランジスタ３６と接続されている。アンドゲート３３Ａは、Ｄ－フリップフロップ３４に接続されている。Ｄ－フリップフロップ３４は、通信モード信号を入力するＤ端子３４ａと、書き込み信号ＷＲバー（以下の説明では、単にＷＲとする）を入力するクロック端子３４ｂと、Ｄ端子３４ａが「１」のとき「１」を出力し、Ｄ端子３４ａが「０」のとき「０」を出力するＱ端子３４ｃを有する。トランジスタ３５は、Ｄ－フリップフロップ３４のＱ端子３４ｃより「１」が出力されると導通状態となる。アンプ３７は、フォトトランジスタ２２Ａで受光した光信号に基づく出力信号を増幅してアンドゲート３３Ｂに入力する。インバータ３８は、読み込み信号ＲＤバー（以下の説明では、単にＲＤとする）を反転させた反転信号を発生する。バッファ３９は、アンドゲート３３Ｂを通過した出力信号を反転信号に同期してデータバスに出力する。

【００１６】以上の構成において、２台の携帯型ゲーム装置間の光通信動作を説明する。２台の携帯型ゲーム装置を用意し、それぞれの本体１０にメモリカード２０を装着して電源をＯＮにする。そして、前面に設けられた十字キー１２および操作ボタン１３，１４を操作して「通信モード」を指令する。

【００１７】次に、図４(a),(b) に示すように、２台のゲーム装置の本体１０Ａ（以下、ゲーム装置１０Ａという）および１０Ｂ（以下、ゲーム装置１０Ｂという）に装着されているメモリカード２０の天面を対向させる。そして、ゲーム装置１０Ａ側の発光部２１とゲーム装置１０Ｂ側の受光部２２、およびゲーム装置１０Ａ側の受光部２２とゲーム装置１０Ｂ側の発光部２１が正対するように配置する。

【００１８】このとき、メモリカード２０の天面間の間隔Ｄが大であると、光信号を受光するフォトトランジスタ２２Ａの反応が不正確となるので近接させることが好ましく、あるいは天面同士を接触させても良い。

【００１９】〔ゲーム装置１０Ａがゲーム装置１０Ｂにデータを送信するとき〕制御部３０のアドレスデコーダ３１は、「通信モード」が指令されると、ゲーム装置１０Ａに内蔵されたＣＰＵα６０からアドレスバスを介してアドレス信号を入出力する。このアドレス信号はデコードされ、動作モード制御回路３２に出力される。動作モード制御回路３２は、アドレスデコーダ３１からのデコード信号と、書き込み信号ＷＲの「０」から「１」への変化（立ち上がり）を入力することによって、動作モード制御回路内に設けられた記憶装置に通信モードを記憶する。この記憶された通信モードを示す信号が、動作モード制御回路から「１」で出力され、アンドゲート３３Ａに入力される。この状態で、アンドゲート３３Ａ

に、ＣＰＵα６０から１ビットのデータと、アドレスデコーダからのデコード信号を入力することによって、アクティブ「１」になる。Ｄ－フリップフロップ３４のＤ端子３４ａは、アンドゲート３３Ａの出力に接続されているので「１」になる。

【００２０】Ｄ端子３４ａに「１」が入力しているとき、クロック端子３４ｂに入力されている書き込み信号ＷＲの「０」から「１」への変化に同期し、Ｑ端子３４ｃが「１」になると、トランジスタ３５が導通し、ＬＥＤ２１Ａに注入電流が供給される。この注入電流は、電源１００から供給される注入電流とコンデンサ２１Ｄに充電された電荷に基づいて発生する注入電流の和の注入電流となるので、ＬＥＤ２１Ａは作動初期における発光強度が大になる。ＬＥＤ２１Ａの発光に基づく光信号L_Aはメモリカード２０Ａの発光部２１から出射される。

【００２１】〔ゲーム装置１０Ａがゲーム装置１０Ｂからデータを受信するとき〕制御部３０のアドレスデコーダ３１は、「通信モード」が指令されるとゲーム装置１０Ａに内蔵されたＣＰＵα６０からアドレスバスを介してアドレス信号を入力する。このアドレス信号はデコードされて動作モード制御回路３２に出力される。動作モード制御回路３２は、アドレスデコーダ３１からデコード信号を入力することによりアクティブとなる。このとき、読み取り信号ＲＤ（「０」信号）のインバータ３８による反転信号（「１」信号）を入力することによってアンドゲート３３Ｂをアクティブにし、かつ、トランジスタ３６を導通させて受光部２２に通電する。

【００２２】メモリカード２０Ａの受光部２２に光信号L_Bが入射すると、フォトトランジスタ２２Ａで受光され、光強度に応じた受光信号に光電変換される。光電変換後の受光信号はアンプ３７で増幅された後、アンドゲート３３Ｂに入力する。アンドゲート３３Ｂは増幅された受光信号を反転信号に同期してバッファ３９に出力する。バッファ３９に入力された受光信号は、読み取り信号ＲＤの反転信号に同期してデータバスに出力される。

【００２３】図５(a),(b) は、本発明の光通信装置の発光電流と受光電流の関係を示し、発光部２１では、図５(a) に示すように、トランジスタ３５の導通時（時刻t_1）に、コンデンサ２１Ｄに充電された電荷に基づく注入電流を電源からの注入電流に加えて供給するので、通常の発光電流I_{z1}より大なる発光電流I_{z1}'がＬＥＤ２１Ａに供給される。このことにより作動初期の発光強度が瞬間的に大になる。コンデンサ２１Ｄの放電後は通常の発光電流I_{z1}となる。

【００２４】受光部２２では、図５(b) に示すように、ＬＥＤ２１Ａの作動初期に通常の発光強度に基づく受光電流I_{z2}より大なる受光電流I_{z2}'が発生するので、受光電流I_{z2}が発生するまでの応答時間Δt（$t_2 - t_1$）が小になり、かつ、受光電流I_{z2}より大なるレベルの受光電流I_{z2}'が発生し、反応が正確になる。

【００２５】上記した光通信装置を備えたゲーム装置によると、２台の携帯型ゲーム装置を近接あるいは接触させて光通信を行うので、ＬＥＤの通常の発光強度を小にでき、電池の容量に基づいて使用電力に制限のある携帯型ゲーム装置でも光通信が可能になる。ＬＥＤは、作動初期に電源に基づく注入電流に加えてコンデンサに充電された電荷に基づく注入電流を供給されることによって、通常の発光強度より大なる発光強度の光信号を出射する。このことによりフォトトランジスタでは受光電流の立ち上がり時間が短くなり、大きなレベルの受光電流が発生し、確実な受光が行われる。また、「通信モード」の設定に基づいて受光回路に通電するようにしているので、電池の消耗が抑制されるとともに通電に伴って発生するノイズを低減することができる。

【００２６】以上説明した光通信装置は、携帯型ゲーム装置に限定されず、他の端末同士の光通信に使用することも可能である。また、発光部および受光部を設ける場所についてもメモリカードに限定されず、例えば、携帯型ゲーム装置本体に設ける構成としても良い。

【００２７】

【発明の効果】以上説明した通り、本発明の光通信装置を備えたゲーム装置によると、電源に基づく注入電流とコンデンサに充電された電荷に基づく注入電流の和の注入電流を作動時に供給される発光部と、光通信を行うときに通電される受光部を設けたため、使用電力に制限がある場合でも負荷を増大させることなく発光側の作動初期の光強度を大にして受信側の応答性、正確性を向上させることができる

【図面の簡単な説明】

【図１】本発明の実施の形態における光通信装置を備えたゲーム装置を示す説明図である。

【図２】本発明の実施の形態における光通信装置を備えたゲーム装置の制御ブロック図である。

【図３】本発明の実施の形態における光通信装置を備えたゲーム装置の回路図である。

【図４】本発明の実施の形態における光通信装置の動作を示す説明図である。

【図５】(a) は、本発明の実施の形態における光通信装置の発光電流と時間の関係を示し、(b) は、受光電流と時間の関係を示す。

【図６】従来の光通信装置の発光回路を示す説明図。

【図７】(a) は、従来の光通信装置の発生回路の発光電流と時間の関係を示し、(b) は、受光電流と時間の関係を示す。

【符号の説明】

１０，本体
１０Ａ，本体
１０Ｂ，本体
１１，液晶ディスプレイ
１２，十字キー

7

１３，操作ボタン
１４，操作ボタン
２０，メモリカード
２０Ａ，メモリカード
２０Ｂ，メモリカード
２１，発光部
２１Ａ，ＬＥＤ
２１Ｂ，抵抗
２１Ｃ，抵抗
２１Ｄ，コンデンサ
２２，受光部
２２Ａ，フォトトランジスタ
２２Ｂ，抵抗
２２Ｃ，抵抗
２２Ｄ，コンデンサ
２２Ｅ，コンデンサ
２２Ｆ，ディスプレイ
３０，制御部
３１，アドレスデコーダ

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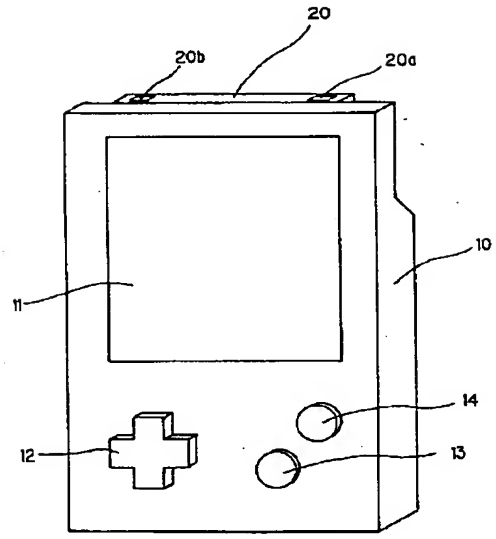
＊３２，動作モード制御回路
３３Ａ，アンドゲート
３３Ｂ，アンドゲート
３４，Ｄ－フリップフロップ
３５，トランジスタ
３６，トランジスタ
３７，アンプ
３８，インバータ
３９，バッファ
４０，電池
４１，リセット回路
５０，ＲＯＭ
５１，ＲＡＭ
５５，電源
５６，抵抗
５７，スイッチ
５８，ＬＥＤ
６０，ＣＰＵα
＊　１００，電源

【図１】



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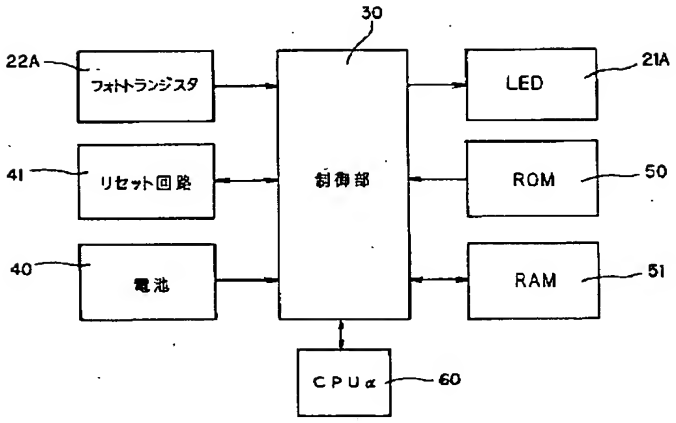

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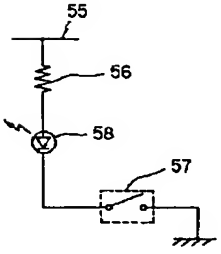
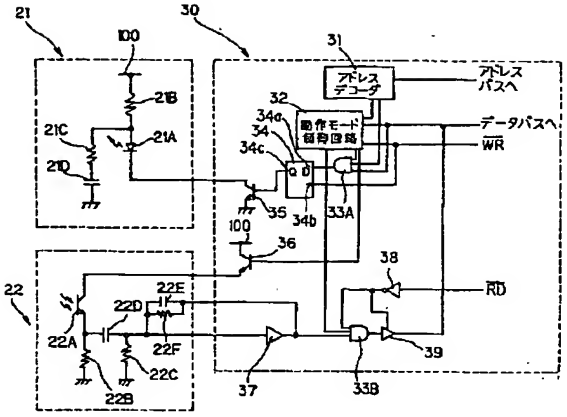
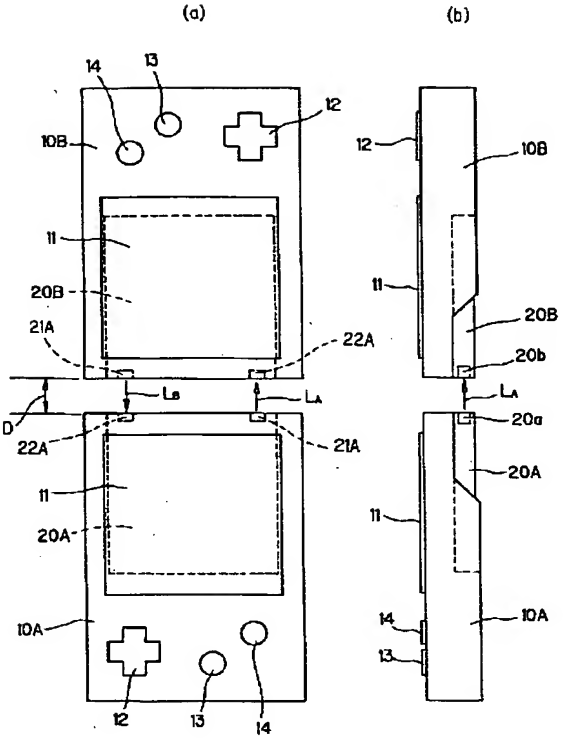


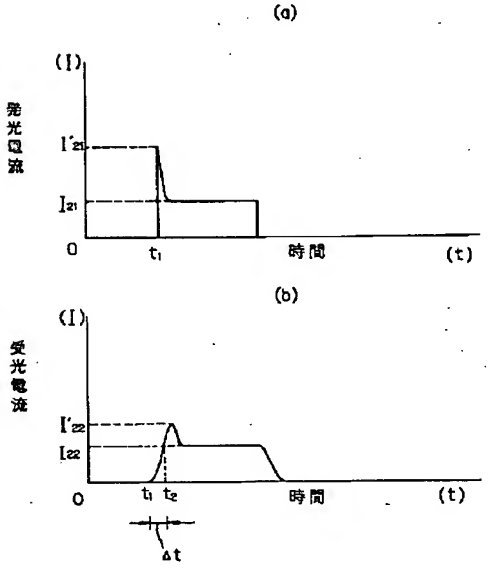
【図３】


21
30
100
31
アドレスデコーダ
アドレスバスへ
21B
21C
21A
21D
32
34a
動作モード制御回路
34
データバスへ
34c
WR
33A
35
34b
100
36
38
RD
22
22E
22D
22A
22F
22C
22B
39
37
33B

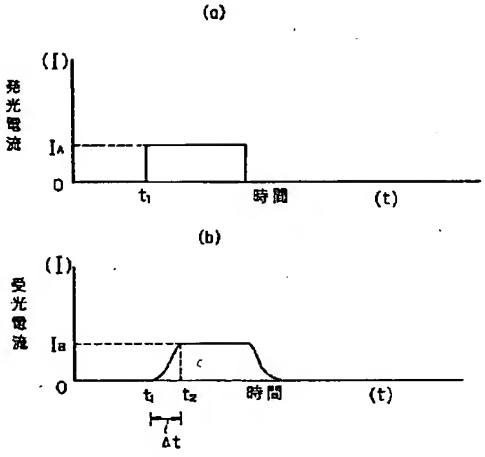
【図４】


(a)
(b)
14
13
12
10B
11
20B
21A
22A
LB
LA
D
21A
11
20A
10A
12
13
14
12
10B
11
20B
20b
LA
20a
20A
11
14
13
10A

【図５】


(a)
(I)
発光電流
I'21
I21
0
t1
時間
(t)
(b)
(I)
受光電流
I'22
I22
0
t1
t2
時間
(t)
Δt

【図７】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(I)
発光電流
IA
0
t1
時間
(t)
(b)
(I)
受光電流
IB
0
t1
t2
時間
(t)
Δt

Bibliography

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[FI]
A63F 9/22 G
[Request for Examination] Un-asking.
[The number of claims] 3
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[Translation done.]

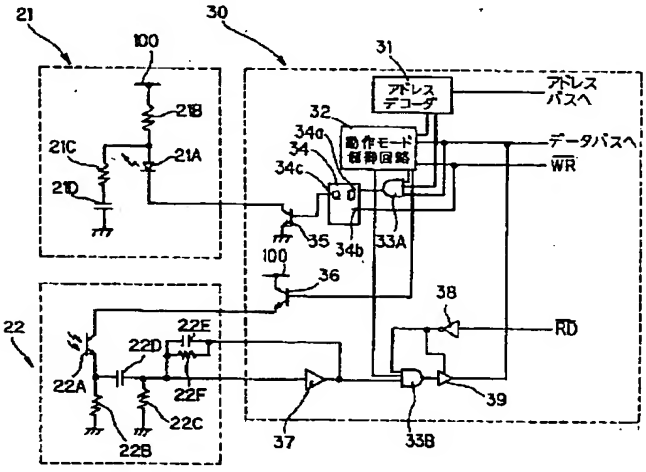
* NOTICES *

Japan Patent Office is not responsible for any
damages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

Summary

(57) [Abstract]
[Technical problem] Game equipment equipped with the optical transmitter-receiver which can make size luminescence intensity in early stages of [operation] a luminescence side, and can raise the responsibility of a receiving side and accuracy is offered without increasing a load, even when used power has a limit.
[Means for Solution] Capacitor 21D is prepared in parallel with Light Emitting Diode21A prepared in a light-emitting part 21, and the inrush current based on a power supply 100 and the inrush current of the sum of the inrush current based on the charge charged by capacitor 21D were supplied at the time of the operation of Light Emitting Diode21A.

[Translation done.]



[Translation done.]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The photogenic organ which carries out outgoing radiation of the lightwave signal to an external instrument based on program execution Optical-communication equipment which has the electric eye which receives the lightwave signal by which outgoing radiation is carried out from the aforementioned external instrument Are game equipment equipped with optical-communication equipment equipped with the above, and it has the capacitor which accumulates the charge supplied from a power supply at the time of un-operating [of the aforementioned photogenic organ]. The luminescence circuit which the 1st inrush current based on the aforementioned power supply and the inrush current of the sum of the 2nd inrush current based on the charge of the aforementioned capacitor are supplied [circuit] at the time of the operation of the aforementioned photogenic organ, and operates the aforementioned photogenic organ, It is characterized by having the light-receiving circuit which reads the output signal generated based on light-receiving of a lightwave signal by which outgoing radiation is carried out from the aforementioned external instrument, and is led synchronizing with a signal.
[Claim 2] The aforementioned luminescence circuit and the aforementioned light-receiving circuit are included in the 1st carried type game equipment. the aforementioned external instrument It is the 2nd carried type game equipment which has the same luminescence circuit as the aforementioned luminescence circuit and the aforementioned light-receiving circuit, and a light-receiving circuit. the above 1st and the 2nd carried type game equipment The aforementioned light-emitting part of one carried type game equipment, and the aforementioned light sensing portion of another carried type game equipment, And game equipment equipped with the optical-communication equipment of composition of being constituted, approaching, arranging the light-emitting part and light sensing portion which counter, and performing optical communication so that the aforementioned light sensing portion

of one carried type game equipment and the aforementioned light-emitting part of another carried type game equipment may counter given in the 1st term of a claim.
[Claim 3] The aforementioned photogenic organ and the aforementioned electric eye are game equipment equipped with the optical-communication equipment given in the 1st term of a claim prepared in the removable memory card which has the storage element which stores a program and data.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to game equipment equipped with the optical-communication equipment which makes possible optical communication between the carried type game equipment which has a limit in used power especially about game equipment equipped with optical-communication equipment, and is excellent in the responsibility of a receiving side, and accuracy.
[0002]
[Description of the Prior Art] There is game equipment equipped with the optical-communication equipment which was made to perform data communication based on a program by transmitting and receiving a lightwave signal between carried type game equipment as conventional game equipment.
[0003] The light-emitting part of conventional optical-communication equipment is shown, it connects with a power supply 55 through resistance 56, drawing 6 has the light emitting device (Light Emitting Diode) 58 turned on based on ON/OFF of a switch 57, and Light Emitting Diode58 turns it on by turning on a switch 57. Incidence of the lightwave signal by which outgoing radiation is carried out based on lighting of Light Emitting Diode58 is carried out to the light sensing portion (not shown) of other game equipments, and photo electric translation is carried out to it,

and it is outputted as a light-receiving signal.
[0004] Drawing 7 (a) and (b) The relation of the current and time which are supplied to a light-emitting part and a light sensing portion is shown, and it is time t1. When it sets and a light-emitting part is turned on, in Light Emitting Diode58, it is drawing 7 (a). It is a power supply to the inrush current IA so that it may be shown. It is supplied. On the other hand, a light sensing portion produces a photocurrent by receiving the lightwave signal based on luminescence of Light Emitting Diode58. this photocurrent -- drawing 7 (b) it is shown -- as -- time t1 from -- going up -- time t2 t-second after delta Current value IB It reaches.
[0005]
[Problem(s) to be Solved by the Invention] However, since according to conventional optical-communication equipment resistance with the predetermined value is inserted in a light emitting device and a serial in order to save the power consumed with a light-emitting part, even if it operates a light emitting device, the level of the current poured into a light emitting device takes time to be restricted, consequently for a photo detector to receive the light of sufficient quantity of light, and has a possibility that the reaction of a receiving side may become inaccurate. Therefore, the purpose of this invention is to offer game equipment equipped with the optical-communication equipment which can make size level of the inrush current at the time of the operation by the side of luminescence, and can raise the responsibility of a receiving side, and accuracy, without increasing a load, even when used power has a limit.
[0006]
[Means for Solving the Problem] In game equipment equipped with the optical-communication equipment which has the photogenic organ which carries out outgoing radiation of the lightwave signal to an external instrument based on program execution, and the electric eye which receives the lightwave signal by which outgoing radiation is carried out from the aforementioned external instrument in order that this invention may realize the above-mentioned purpose It has the capacitor which accumulates the charge supplied from a power supply at the time of un-operating [of the aforementioned photogenic organ]. The luminescence circuit which the 1st inrush current based on the aforementioned power supply and the inrush current of the sum of the 2nd inrush current based on the charge of the aforementioned capacitor are supplied [circuit] at the time of the operation of the aforementioned photogenic organ, and operates the aforementioned photogenic organ, Game equipment equipped with the light-receiving circuit which reads the output signal generated based on light-receiving of a lightwave signal by which outgoing radiation is carried out from the aforementioned external instrument, and is led synchronizing with a signal is offered.
[0007] In game equipment equipped with the above-mentioned optical-communication equipment a luminescence circuit and a light-receiving circuit It is included in the 1st carried type game equipment. an external instrument It is the 2nd

carried type game equipment which has the same luminescence circuit as a luminescence circuit and a light-receiving circuit, and a light-receiving circuit. the 1st and 2nd carried type game equipment The light-emitting part of one carried type game equipment, and the light sensing portion of another carried type game equipment, And considering as the composition which performs optical communication is desirable by approaching and arranging the light-emitting part and light sensing portion which are constituted and counter so that the light sensing portion of one carried type game equipment and the light-emitting part of another carried type game equipment may counter. Moreover, a photogenic organ and an electric eye can also be prepared in the removable memory card which has the storage element which stores a program and data.

[0008]

[Embodiments of the Invention] Drawing 1 shows carried type game equipment equipped with the optical-communication equipment in the form of operation of this invention, and has the memory card 20 with which the main part 10 with which a liquid crystal display 11, the cross-joint key 12, and the operation buttons 13 and 14 have been arranged in the front face, and a main part 10 are equipped free [attachment and detachment], and the light-emitting part 21 and light sensing portion 22 which transmit and receive the lightwave signal based on data are prepared in the top panel of memory card 20.

[0009] Drawing 2 shows the control-block view of memory card 20. This memory card 20 has the control section 30 which controls operation of each part. Light Emitting Diode21A which generates a lightwave signal based on the control signal outputted from a control section 30, Photo transistor 22A which carries out photo electric translation of the lightwave signal which received light according to optical intensity, When memory card 20 is removed from ROM50 which stored the program, RAM51 which stores the data generated during game execution, and a main part 10 CPUalpha60 which are built in the reset circuit 41 and main part 10 which protect the data of the game stored in RAM51 by supplying power from a cell 40, and input the address, data, a write-in signal WR bar, and a reading signal RD bar into a control section 30 are connected, and it is constituted.

[0010] Drawing 3 shows the circuit diagram of the optical-communication section of memory card 20, connects a light-emitting part 21 and a light sensing portion 22 to a control section 30, and is constituted.

[0011] A light-emitting part 21 has Light Emitting Diode21A, Resistance 21B and 21C, and capacitor 21D, and Light Emitting Diode21A connected to a power supply 100 through resistance 21B is connected to the transistor 35 of a control section 30. Moreover, in parallel with Light Emitting Diode21A, capacitor 21D is connected through resistance 21C, and in order to reduce the power consumption of a power supply 100, the resistance of resistance 21B is set up so that it may become size from the resistance of resistance 21C. If the "communicate mode" is set up by the control section 30, a transistor 35 will turn on and energize a power supply 100.

[0012] Capacitor 21D charges a charge at the time of putting out lights during lighting of Light Emitting Diode21A, and supplies the inrush current based on a power supply, and the inrush current of the sum of the inrush current based on the charge charged by capacitor 21D to Light Emitting Diode21A at the time of the flow of a transistor 35.
[0013] A light sensing portion 22 has photo transistor 22A, Resistance 22B and 22C, Capacitors 22D and 22E, and resistance 22F, it connects with the transistor 36 of a control section 30, and photo transistor 22A is grounded through resistance 22B for photocurrent-voltage conversion. Moreover, resistance 22C is connected through capacitor 22D in parallel with resistance 22B. It connects with the amplifier 37 of a control section 30, resistance 22F and capacitor 22E is connected in parallel with amplifier 37, and the output terminal of capacitor 22D constitutes the feedback amplifier.
[0014] The control section 30 consists of an address decoder 31, the mode-of-operation control circuit 32, AND gates 33A and 33B, the D-flip-flop 34, transistors 35 and 36, amplifier 37, an inverter 38, and a buffer 39.
[0015] The address decoder 31 is connected with the mode-of-operation control circuit 32 and AND-gate 33A. The mode-of-operation control circuit 32 is connected with AND gates 33A and 33B and the transistor 36. AND-gate 33A is connected to the D-flip-flop 34. The D-flip-flop 34 outputs "1", when D terminal 34a which inputs a communicate mode signal, clock terminal 34b which inputs a write-in signal WR bar (only referred to as WR in the following explanation), and D terminal 34a are "1", and when D terminal 34a is "0", it has Q terminal 34c which outputs "0." A transistor 35 will be in switch-on, if "1" is outputted from Q terminal 34c of the D-flip-flop 34. Amplifier 37 amplifies the output signal based on the lightwave signal which received light by photo transistor 22A, and inputs it into AND-gate 33B. An inverter 38 generates the reversal signal which reversed the reading signal RD bar (only referred to as RD in the following explanation). A buffer 39 outputs the output signal which passed AND-gate 33B to a data bus synchronizing with a reversal signal.
[0016] In the above composition, optical-communication operation for two sets of carried type game equipments is explained. Two sets of carried type game equipments are prepared, each main part 10 is equipped with memory card 20, and a power supply is turned ON. And the cross-joint key 12 and the operation buttons 13 and 14 which were prepared in the front face are operated, and it is ordered the "communicate mode."
[0017] Next, drawing 4 (a) and (b) The top panel of the memory card 20 with which the main parts 10A (henceforth game equipment 10A) and 10B (henceforth game equipment 10B) of two sets of game equipments are equipped is made to counter so that it may be shown. And it arranges so that the light-emitting part 21 by the side of game equipment 10A, the light sensing portion 22 by the side of game equipment 10B and the light sensing portion 22 by the side of game equipment 10A, and the

light-emitting part 21 by the side of game equipment 10B may carry out a right pair.
[0018] At this time, it may be desirable to make it approach, since the reaction of photo transistor 22A which receives a lightwave signal as the interval D between the top panels of memory card 20 is size becomes inaccurate, or it may contact top panels.
[0019] [Time of game equipment 10A transmitting data to game equipment 10B If ordered the address decoder 31 of a control section 30 in the "communicate mode", it will output from CPUalpha60 built in game equipment 10A and input an address signal through an address bus.] This address signal is decoded and is outputted to the mode-of-operation control circuit 32. The mode-of-operation control circuit 32 memorizes the communicate mode to the storage formed in the mode-of-operation control circuit by inputting the change (standup) to "1" of the decoding signal from an address decoder 31, and the write-in signal WR from "0." The signal which shows this memorized communicate mode is outputted by "1" from a mode-of-operation control circuit, and is inputted into AND-gate 33A. active by inputting the decoding signal from an address decoder into AND-gate 33A as CPUalpha60 to 1-bit data in this state -- it is set to "1" Since it connects with the output of AND-gate 33A, D terminal 34a of the D-flip-flop 34 is set to "1."
[0020] If it synchronizes with the change to "1" of the write-in signal WR inputted into clock terminal 34b from "0" and Q terminal 34c is set to "1" when "1" has inputted into D terminal 34a, a transistor 35 will flow and an inrush current will be supplied to Light Emitting Diode21A. Since this inrush current turns into an inrush current supplied from a power supply 100, and an inrush current of the sum of the inrush current generated based on the charge charged by capacitor 21D, luminescence intensity [in / the early stages of an operation / in Light Emitting Diode21A] becomes size. Lightwave signal LA based on luminescence of Light Emitting Diode21A Outgoing radiation is carried out from the light-emitting part 21 of memory card 20A.
[0021] [Time of game equipment 10A receiving data from game equipment 10B] If ordered the address decoder 31 of a control section 30 in the "communicate mode", it will input an address signal through an address bus from CPUalpha60 built in game equipment 10A. This address signal is decoded and is outputted to the mode-of-operation control circuit 32. The mode-of-operation control circuit 32 becomes active by inputting a decoding signal from an address decoder 31. At this time, by inputting the reversal signal ("1" signal) by the inverter 38 of the reading signal RD ("0" signals), make AND-gate 33B active, and it is made to flow through a transistor 36, and energizes to a light sensing portion 22.
[0022] It is a lightwave signal LB to the light sensing portion 22 of memory card 20A. If incidence is carried out, light will be received by photo transistor 22A, and photo electric translation will be carried out to the light-receiving signal according to optical intensity. After the light-receiving signal after photo electric translation is amplified with amplifier 37, it is inputted into AND-gate 33B. AND-gate 33B outputs

the amplified light-receiving signal to a buffer 39 synchronizing with a reversal signal. The light-receiving signal inputted into the buffer 39 is outputted to a data bus synchronizing with the reversal signal of the reading signal RD.

[0023] Drawing 5 (a) and (b) The relation between the luminescence current of the optical-communication equipment of this invention and light-receiving current is shown. in a light-emitting part 21 Drawing 5 (a) Since the inrush current based on the charge charged by capacitor 21D at the time of the flow of a transistor 35 (time t1) is added and supplied to an inrush current from a power supply so that it may be shown, luminescence current I21' which consists of usual luminescence current I21 size is supplied to Light Emitting Diode21A. The luminescence intensity in early stages of an operation becomes size momentarily by this. After electric discharge of capacitor 21D serves as usual luminescence current I21.

[0024] At a light sensing portion 22, it is drawing 5 (b). Since light-receiving current I22' which becomes in early stages of [operation] Light Emitting Diode21A from the light-receiving current I22 based on the usual luminescence intensity size occurs so that it may be shown Light-receiving current I22' of the level which response-time deltat (t2-t1) until light-receiving current I22 occurs becomes smallness, and consists of light-receiving current I22 size occurs, and a reaction becomes exact.

[0025] Since according to game equipment equipped with the above-mentioned optical-communication equipment two sets of carried type game equipments are approached or contacted and optical communication is performed, the usual luminescence intensity of Light Emitting Diode is made to smallness, and optical communication becomes possible also with the carried type game equipment which has a limit in used power based on the capacity of a cell. Light Emitting Diode carries out outgoing radiation of the lightwave signal of the luminescence intensity which consists of the usual luminescence intensity size by supplying the inrush current based on the charge which was charged by the capacitor in early stages of the operation in addition to the inrush current based on a power supply. By the photo transistor, the build up time of light-receiving current becomes short by this, the light-receiving current of big level occurs, and positive light-receiving is performed. Moreover, since it is made to energize in a light-receiving circuit based on a setup of the "communicate mode", while exhaustion of a cell is suppressed, the noise generated with energization can be reduced.

[0026] It is not limited to carried type game equipment, but the optical-communication equipment explained above can also be used for the optical communication of other terminals. Moreover, it is good also as composition which it is not limited to memory card about the place in which a light-emitting part and a light sensing portion are prepared, for example, is prepared in the main part of carried type game equipment.

[0027]

[Effect of the Invention] According to game equipment equipped with the optical-communication equipment of this invention, as explained above Since the light-

emitting part to which the inrush current of the sum of the inrush current based on a power supply and the inrush current based on the charge charged by the capacitor is supplied at the time of an operation, and the light sensing portion energized when performing optical communication were prepared, Without increasing a load, even when used power has a limit, optical intensity in early stages of [operation] a luminescence side can be made into size, and the responsibility of a receiving side and accuracy can be raised.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is explanatory drawing showing game equipment equipped with the optical-communication equipment in the gestalt of operation of this invention.
[Drawing 2] It is the control-block view of game equipment equipped with the optical-communication equipment in the gestalt of operation of this invention.
[Drawing 3] It is the circuit diagram of game equipment equipped with the optical-communication equipment in the gestalt of operation of this invention.
[Drawing 4] It is explanatory drawing showing operation of the optical-communication equipment in the gestalt of operation of this invention.
[Drawing 5] (a) The luminescence current of optical-communication equipment and the relation of time to the gestalt of operation of ** and this invention are shown, and it is (b). The relation between light-receiving current and time is shown.
[Drawing 6] Explanatory drawing showing the luminescence circuit of conventional optical-communication equipment.
[Drawing 7] (a) The luminescence current of the generating circuit of ** and conventional optical-communication equipment and the relation of time are shown, and it is (b). The relation between light-receiving current and time is shown.
[Description of Notations]
10 Main part
10A, a main part

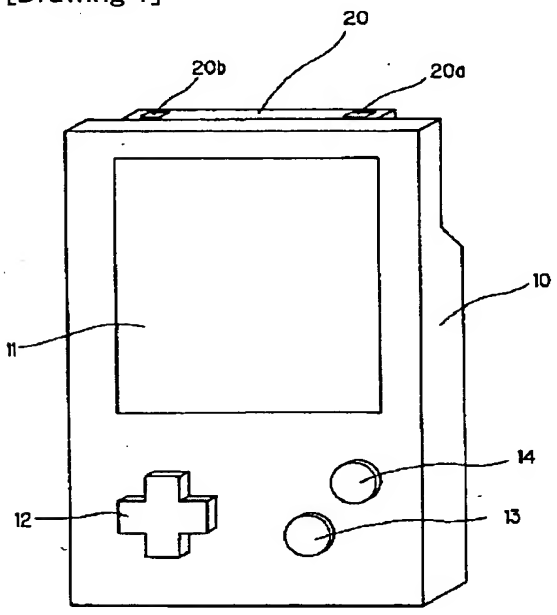
10B, a main part
11 Liquid crystal display
12, a cross-joint key
13, an operation button
14, an operation button
20 Memory card
20A, memory card
20B, memory card
21 Light-emitting part
21A,LED
21B, resistance
21C, resistance
21D, a capacitor
22 Light sensing portion
22A, a photo transistor
22B, resistance
22C, resistance
22D, a capacitor
22E, a capacitor
22F, a display
30 Control section
31 Address decoder
32, a mode-of-operation control circuit
33A, an AND gate
33B, an AND gate
34, D-flip-flop
35 Transistor
36 Transistor
37 Amplifier
38 Inverter
39 Buffer
40 Cell
41 Reset circuit
50,ROM
51,RAM
55 Power supply
56 Resistance
57 Switch
58,LED
60 CPUalpha
100 Power supply

[Translation done.]

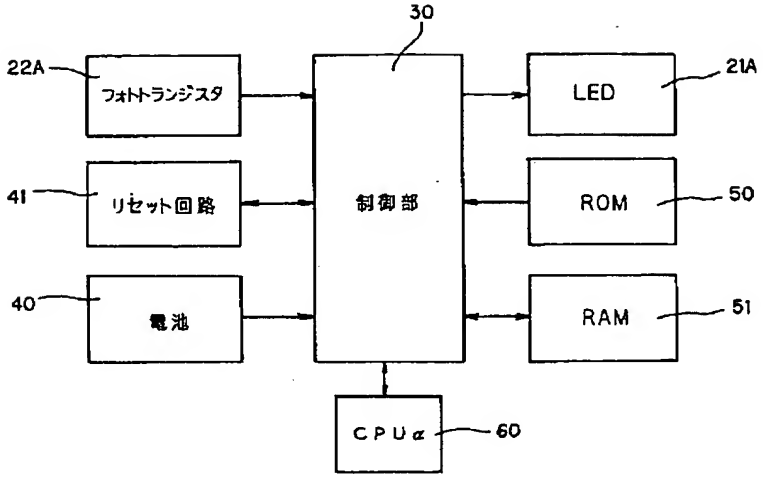
* NOTICES *

DRAWINGS

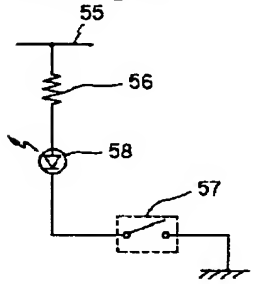
[Drawing 1]



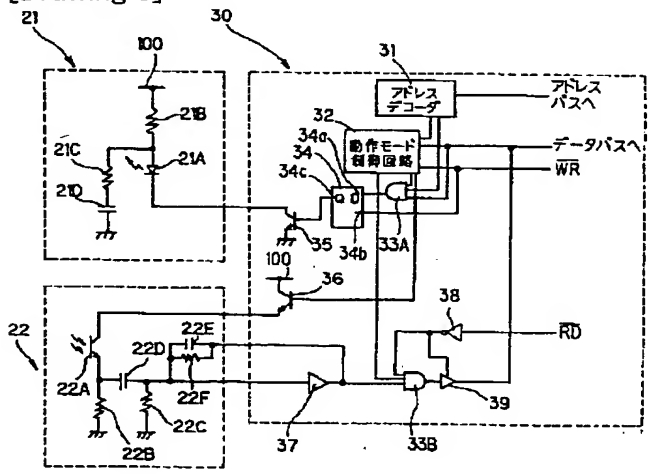
[Drawing 2]



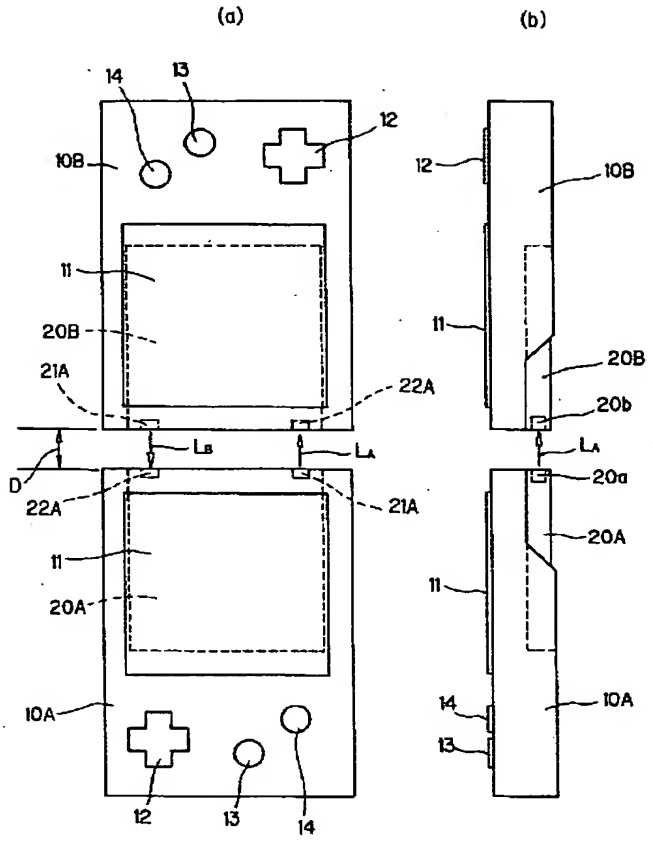
[Drawing 6]



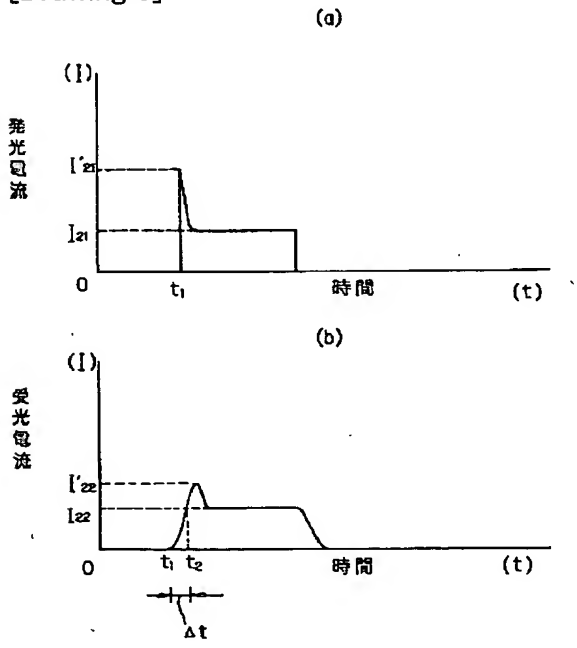
[Drawing 3]



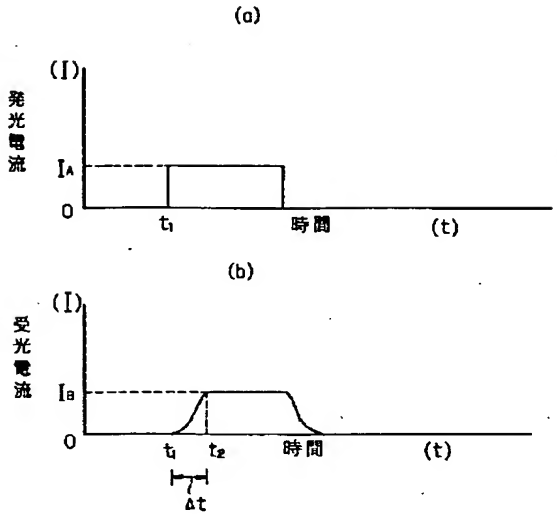
[Drawing 4]



[Drawing 5]



[Drawing 7]



[Translation done.]